(12) UK Patent Application (19) GB (11) 2 017 224 A

(21) Application No 7909299
(22) Date of filing 16 Mar 1979
(23) Claims filed 16 Mar 1979
(30) Priority data
(31) 2812927
(32) 23 Mar 1978
(33) Fed. Rep of Germany (DE)
(43) Application published 3 Oct 1979
(51) INT CL²
F15B 13/02
(52) Domestic classification
F1P 10X 13
(56) Documents cited
GB 1533202
GB 1364749
GB 1341908
GB 995350
(58) Field of search
F1P
(71) Applicant
Rötelmann & Co.,
Heinrichstrasse 1, D-5980
Werdohl, West Germany
(72) Inventor
Lothar Kirchoff-Stewens
(74) Agent
Wynne-Jones, Lainé & James

(54) Intermediate Plate for a Hydraulic Linkage System

(57) An intermediate plate (11) interconnects connection plates with connection and control blocks, such as routing valves. The intermediate plate (11) is secured to a connection plate by a screw (63) passing through a drillhole (59). The head (65) of the screw (63) is enlarged and received within a mounting space (61) and incorporates an internal thread (67) to receive the end of a fixing screw (69) for securing the control block to the intermediate plate (11). The screw (63), when in position, may be fixed by a locking screw (71). This arrangement enables the control block to be removed without disturbing the interconnection between the intermediate plate (11) and the connection plate. The intermediate plate (11) will incorporate shut-off valves.

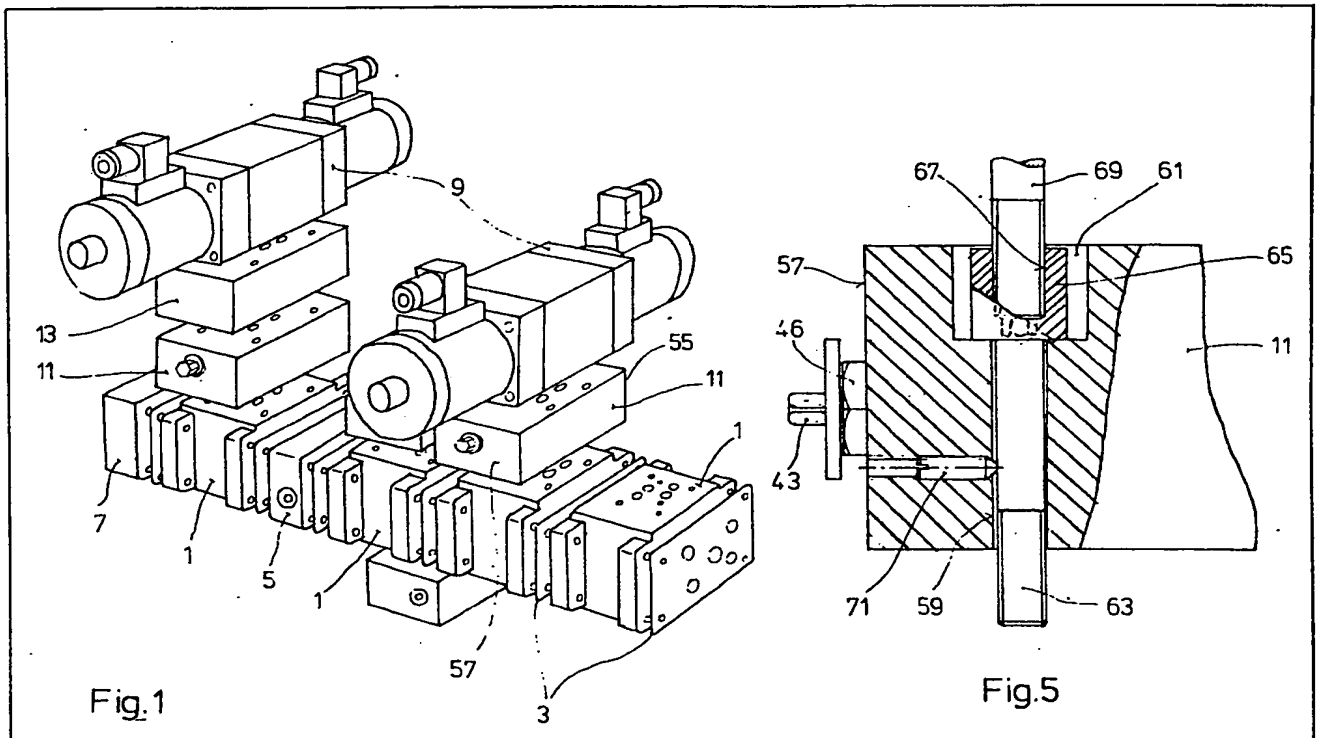

Fig.1

Fig.5

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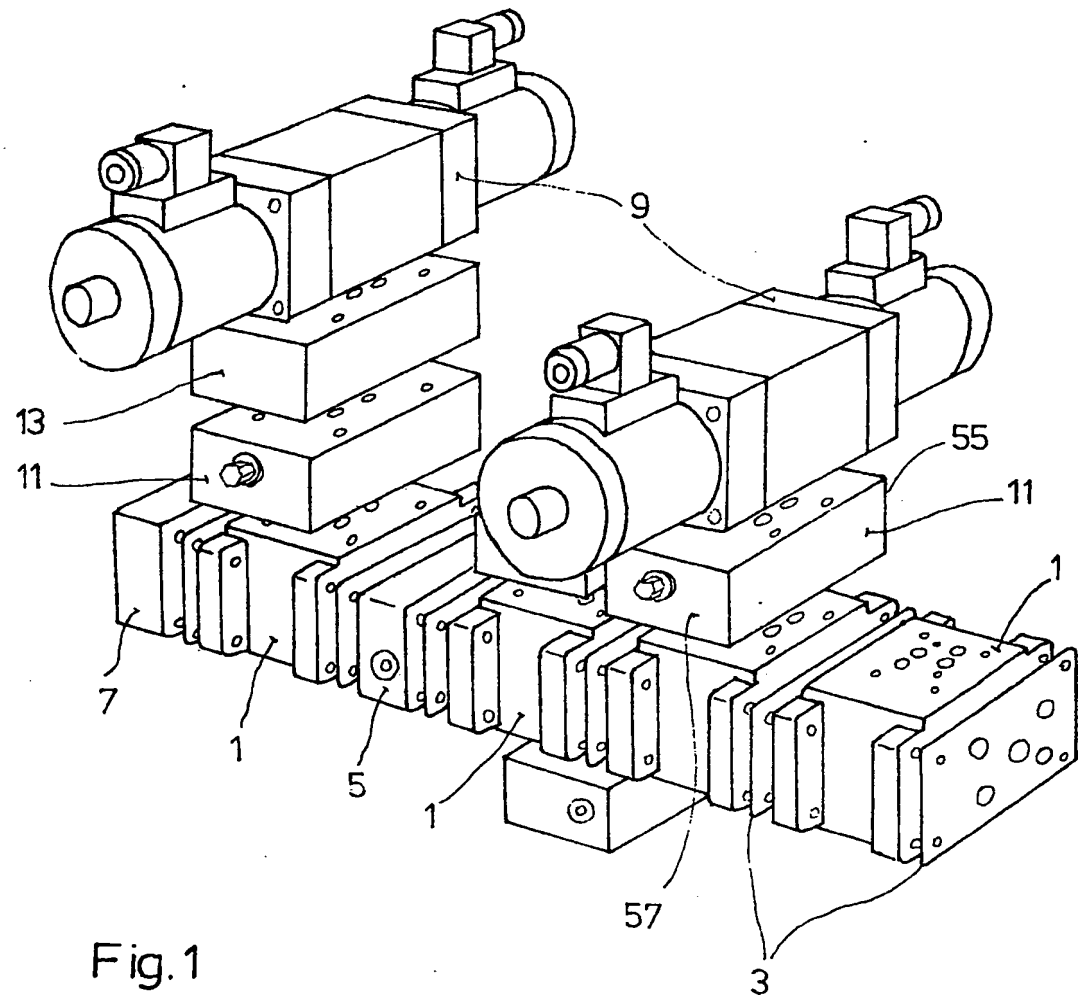

Fig.1

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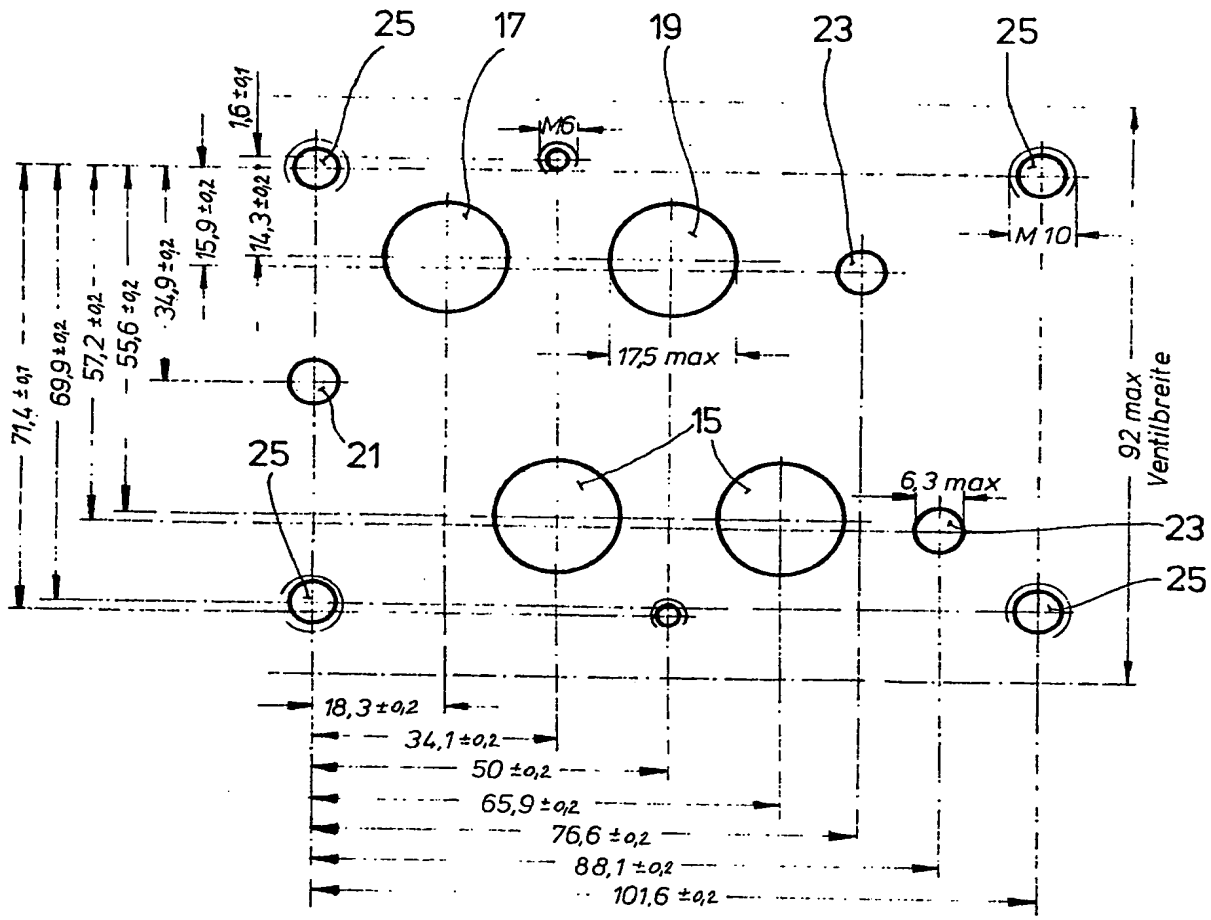

Fig. 2

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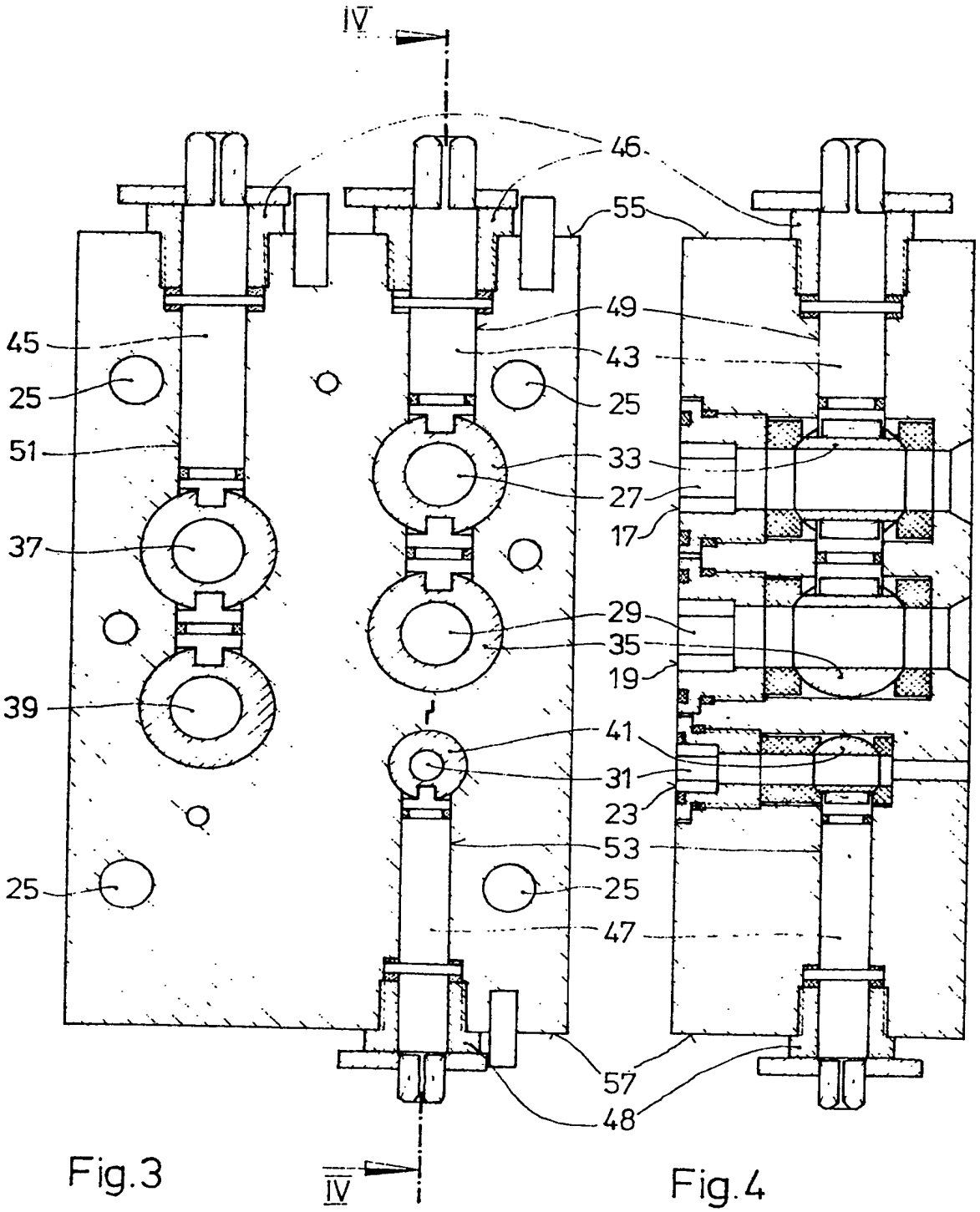

Fig.3

Fig.4

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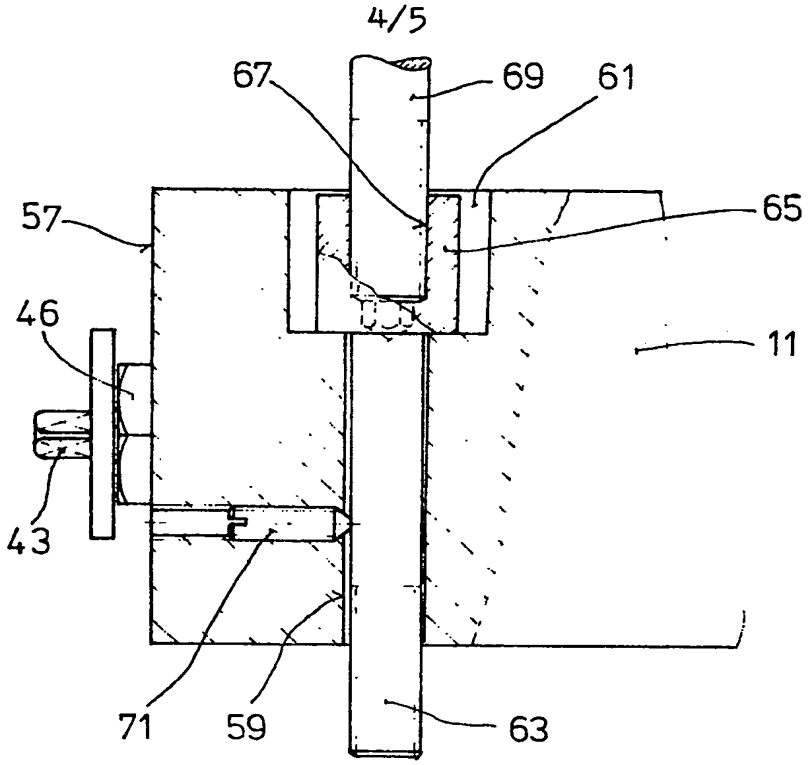

Fig.5

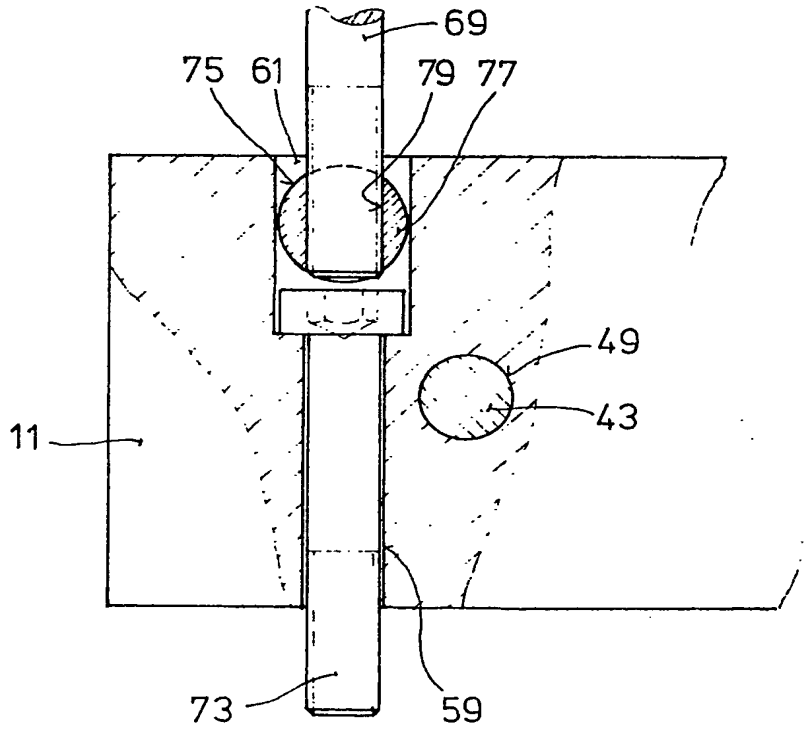

Fig.6

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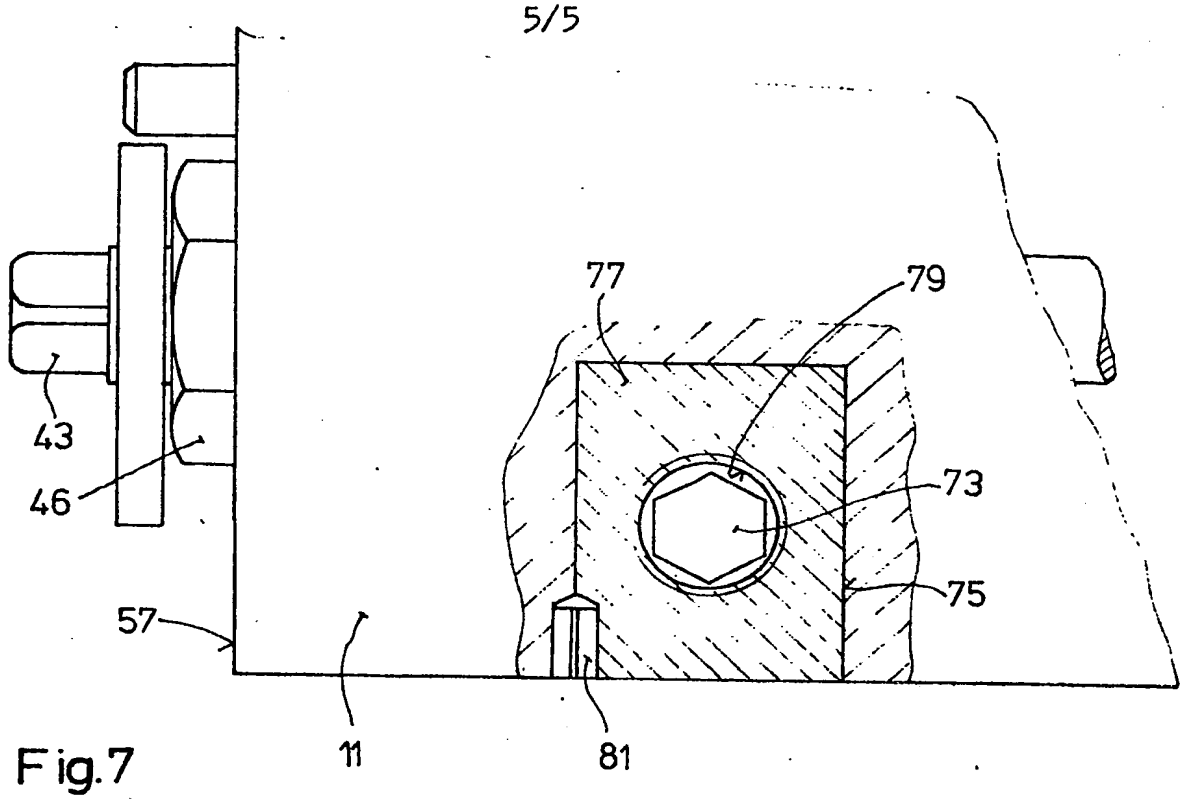

Fig.7

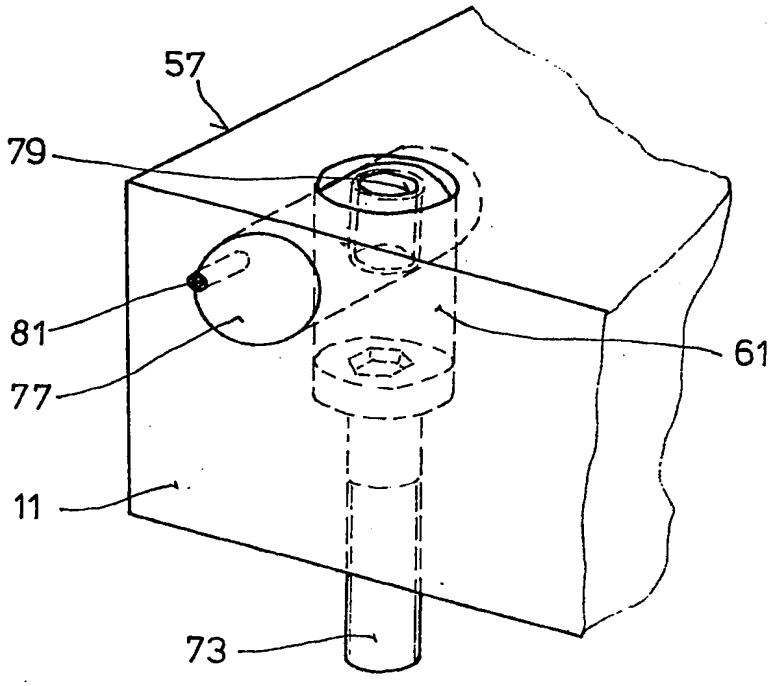

Fig.8

SPECIFICATION

Intermediate Plate for a Hydraulic Linkage System

A hydraulic linkage system serves for the construction of hydraulic control plants using collective connection plates and connection and control blocks, for example routing valves, which are joined together largely without pipes. The connection plates are blocks with through channels and branch channels which end on the outsides of the plates. The linkage system may be assembled by appropriate screwing together of the different connection plates and control blocks. The hole patterns on the surfaces of such plates and blocks are standarized by DIN 24340 in accordance with the CETOP standard (Comité Européen de Transmissions Olé ohydrauliques et Pneumatiques).

Known components in the linkage system are, among others, intermediate plates which, for example with vertical linkage, are engaged between the connection plate and the superimposed routing valve and contain non-return valves and also if necessary perform special functions, for example to enable a secondary connection to branch off through the connection plate.

With known linkage systems there is the difficulty that if necessary individual functional units have to be exchanged, for example magnetically actuated routing valves then for this purpose the whole plant has to be switched off and emptied. This results in shutdown periods for all controlled systems connected to the linkage system and also in problems for the hydraulic plant itself in respect of its subsequent refilling, venting, etc. The bigger the plants constructed in the linkage system, the longer on the one hand these shutdown periods become because the large number of functional units results in a higher exchange frequency, and the more extensive the plants which have to be shut down.

The object of the invention is to facilitate switching-off of individual branches of the linked plant, for example for the purpose of exchanging a routing valve, without switching off and emptying the whole hydraulic plant.

Accordingly this invention provides an intermediate plate for a hydraulic linkage system for insertion between a linkage connection plate and a connection or control block branching off from the latter, with connection drill-holes whose hole patterns resemble those of the connection plate or of the connection or control block and between which run channels which at least partially envelop stop-cock devices for hydraulic switch functions, and having fixing holes, for fixing the intermediate plate between the connection plate and the connection or control block, which are formed for separate screwing of the intermediate plate on the one hand to the connection plate and on the other hand to the connection or control block.

An intermediate plate thus inserted in sandwich fashion, if necessary with additional interposition of sealing plates, enables the pressure lines or, if so desired, all the lines, to be shut off with the aid of the stop-cocks, whereupon the connection or control block, for example the routing valve with or without a further intermediate block, can be screwed off without the intermediate plate according to the invention also being detached at the same time. The intermediate plate then serves, during assembly, as a shutoff block and can be switched back to transmission after the connection or control block has been replaced, without the intermediate plate having to be detached from the connection plate. Particularly suitable stop-cocks in this case are ball-cocks, which are of small constructions and, as is well known, particularly suitable for switching high pressures. The stop-cocks can be switched with switching bars, by means of which the switching operation is transmitted to the inside of the plate by longitudinal movement, rotation or the like.

Ideally the stop-cocks are controlled via actuation drill-holes from one or both (narrow) end faces of the intermediate plate, in which holes, in the case of ball-cocks, torsion bars or spindles run. Control from the end faces enables the intermediate plates to be mounted consecutively on the connection plates adjacent to each other, so that the intermediate plates and the functional units placed on them can lie side by side. Separate attachment of the intermediate plate on the one hand and of the functional unit in the form of the connection or control block placed on it on the other hand involves certain constructional difficulties. The overall dimensions are limited and are taken up by the through channels and the stop-cocks and their actuation devices. With hole patterns in accordance with DIN 24340, for instance, the fixing holes for the screws have precise locations and come relatively near to the channels for the flow of media, and thus, in the present arrangement, to the actuation drill-holes for the stop-cocks. In the region of the intermediate plate the fixing holes are not only simple drill-holes with the diameter of the screw bolt, but in places include considerable bulges or recesses in order to make room for the screw-head of the screw screwing the intermediate plate to the connection plate beneath it. Only very narrow manufacturing tolerances, which would render the intermediate plate more expensive, make it possible to avoid the danger of these bulges or recesses cutting the actuation channel. This would result in unwanted losses of waste oil.

It is possible to locate the fixing holes in flanges, at the top and bottom of the intermediate plate, between which a somewhat wider free space remains for example makes room for the head of a recessed head screw. The fixing hole in the lower flange is a clear drill-hole, the fixing hole in the upper flange a threaded drill-hole. The screw for the lower flange for screwing to the connection plate cannot of course be inserted through the upper drill-hole as its screw-head is

too big. So with this sort of construction it must be inserted previously from the side and then screwed in from above with the aid of the hollow wrench. However, this construction is less preferable because it is expensive as a result of the cutting, critical in respect of tolerances, and entails difficulties if several intermediate plates with connection or control blocks placed on them lie immediately next to each other as routing valves, so that lateral insertion and extraction of the screws is not possible without further measures.

So it is preferable not to insert the thread for the upper screw, which is for fixing the connection or control block, namely the functional unit, until later in a mounting space, provided for that purpose, in the line of the fixing holes. Accordingly the intermediate plate is ideally formed so that, at the location of the fixing holes of the connection plate and of the connection or control block, there is, in the intermediate plate, on the one hand a fixing hole for a screw to be screwed in the connection plate and on the other hand a mounting space for insertion of a thread for a screw holding the connection or control block. With such an intermediate plate there will be screws for screwing the intermediate plate to the connection plate and preferably each such screw being built-up screw which has a drill-hole with an internal thread in the screw-head coaxially with its bolt, and that a drill-hole receiving the screw-head runs into the intermediate plate from the connecting surface of the connection or control block to form the mounting space. The built-up screw will serve as the lower screw for this purpose, its screw-head containing the thread for the upper screw. The hexagonal head of the built-up screw will be somewhat higher than normal screw-heads in order to give the required screw-in length. The drill-hole which is needed for the screw-head and which has a diameter such that a wrench can be placed on the screw-head, can be located substantially outside the region of the actuation drill-holes owing to the greater plate thickness, so that tightness is ensured and greater manufacturing tolerances can be permitted. The build-up screw can be inserted and screwed in from the connecting surface of the connection or control block, and in the thread of its head there is then screwed-in the screw with which the connection or control block is fixed. The built-up screw is ideally locked in a desired position by the usual means, for example with a holding screw which is screwed in from the face of the intermediate plate and presses on the shaft of the built-up screw, so that the latter is not loosened if the upper fixing screw is screwed out.

An alternative possibility consists in using a screw, such as a recessed head screw for fixing the intermediate plate to the connection plate, around whose screw-head it is not necessary to have a free space for engaging a wrench and which is inserted in a corresponding drill-hole, with a sufficient diameter for the screw-head, made from the connecting side for the connection or control block. In order that, after this recessed-head screw has been screwed in, a thread for the screw above it with the same thread diameter for fixing the connection or control block is provided above the recessed-head screw in the same drill-hole, a bolt with a transverse drill-hole providing this thread may be inserted in an existing channel. The second screw is then screwed into this thread from above. This bolt is preferably a circular cylindrical bolt with guides for fixing its angular position in the channel in the form of a circular cylindrical drill-hole.

Through these measures the intermediate plate can be fixed to the connection plate, independently of the fixing of the block placed on the connection plate, whilst retaining the standarized locations for the fixing holes and without substantial additional assembly work. The connection plates and the connection or control blocks need no different construction for insertion of the intermediate plate.

The invention may be performed in various ways and preferred embodiments thereof will now be described with reference to the accompanying drawings, in which:—

Figure 1 is an exploded view of a hydraulic control plant with a linkage system using intermediate plates according to the invention;

Figure 2 is an example of a hole pattern according to DIN 24340;

Figure 3 is a section through an intermediate plate according to the invention for the hole pattern of Figure 2;

Figure 4 is a vertical section on the line IV—IV through the intermediate plate of Figure 3;

Figure 5 is a partial longitudinal section through an intermediate plate of the invention to show one version of a screw joint;

Figure 6 is a partial cross-section through a modified embodiment of the intermediate plate of the invention to show another version of a screw joint;

Figure 7 is a partial horizontal section through an embodiment of the intermediate plate of the invention slightly modified from Figure 6; and

Figure 8 is a perspective diagram to illustrate the screw system according to Figures 6 and 7.

Figure 1 shows a general diagram of a hydraulic control plant using the linkage system of this invention. In the longitudinal direction the plant consists of a number of connection plates 1 with internal channels and branch channels which end towards the outside in standardized hole patterns. Between the connection plates 1 lie sealing plates 3, and in the example shown a deflector plate 5 is also incorporated. The termination is formed by end plates 7 (1 shown). On two of the connection plates 1 are shown magnetically actuated routing valves 9 of which one is connected via an intermediate plate 11 according to the invention and another also via an intermediate plate 11 and additionally via a non-return valve intermediate plate 13.

This arrangement is shown by way of example.

The linkage system permits the construction of many different installations using a limited number of components. Other functional units can also be connected instead of the routing valves 9; for example, connection blocks for connecting various functional units or other control blocks with measuring appliances.

The intermediate plate 11 permits the routing valve 9 in question to be made pressureless when necessary by blocking the pressure-conducting channels or all the channels. When blocking has been effected, the routing valve 9 in question can be removed for exchange, repair or maintenance.

The hole patterns of the connection plates, intermediate plates and control blocks are standarized under DIN 24340. Figure 2 shows an example of a standardized hole pattern of form A for nominal size 16 including measurements (hole pattern A 16 DIN 24340) for mounting routing valves, and having a valve width "Ventribeite" of 92 max. The hole pattern comprises two working connections 15, a tank connection 17, a pressure connection 19, a waste-oil connection 21, control connections 23 and fixing holes 25. The arrangement and diameter of these holes are laid down.

Figures 3 and 4 illustrate the internal structure of the intermediate plate 11 for placing on the connection plate 1 with the hole pattern according to Figure 2. To the tank connection 17 is connected a channel 27, to the pressure connection 19 a channel 29 and to the control connection 23 a channel 31. Corresponding channels 37 and 39 are connected to the working connections 15. In the path of the channel 27 is a ball-cock 33, in the path of the channel 29 a ball-cock 35, and there are also ball-cocks in the path of the channels 37 and 39 also referred to by the references 37 and 39. In the path of the channel 31 connected to the control connection 23 is a smaller ball-cock 41. The ball-cocks 33 and 35 or 37 and 39 are in each case made in the form of double ball-cocks with joint control. This control is effected for ball-cocks 33 and 35 via a torsion bar 43 and for ball-cocks 37 and 39 via a torsion bar 45. The ball-cock 41 for the control channel 31 is actuated via a torsion bar 47. The torsion bar 43 is disposed rotatably in an actuation drill-hole 49, the torsion bar 45 in an actuation drill-hole 51 and the torsion-bar 47 in an actuation drill-hole 53. The actuation drill-holes end at the parallelepipedal intermediate plate 11 as shown in the drawing at one of the narrow faces 55 and 57, which are freely accessible when the hydraulic control plant is assembled according to Figure 1, even when the intermediate plates and the routing valves lie directly next to each other. The torsion bars 43, 45 and 47 are sealed with stuffing-box studs 46, 48 towards the interior and in each case end outside the intermediate plate 11 in a square cross-section head. Their torsional range is limited by known means. The whole cock and shutoff arrangement is miniaturized in the way shown in the drawing, which makes intermediate plates of small dimensions possible, taking account of the standardized hole patterns.

The fixing holes 25 are not as in the case of known intermediate plates, e.g. the non-return valve intermediate plate 13, simply through drill-holes through which the bolts of the screws joining the routing valves to the connection plates are inserted, but provide a separate fixing and detaching facility on the one hand for the intermediate plate 11 and on the other hand for the routing valve 9 in question to or from the connection plate 1. As Figure 3 shows, the fixing holes 25 pass the neighbouring actuation drill-holes 49, 51 and 53 at a relatively small but, with the standarized drill-hole diameter, sufficient distance. Recesses or bores for accommodating screw-heads and other mounting spaces must, however, be made very carefully in order to rule out the danger of the fixing holes 25, enlarged in this way, cutting the neighbouring actuation drill-holes 49, 51 or 53 within the permitted manufacturing tolerances.

In the case of the construction according to Figure 5 the fixing hole 25 consists of a lower drill-hole 59 which ends at the lower connecting surface to be laid against the connection plate 1 and of a considerably widened upper drill-hole, lying coaxially with the extension of the lower drill-hole 59, in the form of a mounting space 61. The mounting space 61 lies sufficiently high in the intermediate plate 11 not to touch or endanger any adjacent actuation drill-hole.

Into the fixing hole 25 is inserted a built-up screw 63 whose shaft runs through the lower drill-hole 59 and is then screwed in the connection plate 1, while its relatively high head 65 lies in the mouting space 61 and rests against the shoulder lying between the mounting space 61 and the lower drill-hole 59. In the screw-head 65 is located, coaxially with the screw, a drill-hole with an internal thread 67 identical to the thread on the screw bolt of the built-up screw 63 and, according to DIN 24340, with a thread depth at least equal to 1.5 times the thread's diameter. When the routing valve 9 in question is being mounted, a fixing screw 69 for the routing valve is screwed into the thread 67. The built-up screw 63 can be locked with a locking screw 71 which engages the screw bolt of the built-up screw 63 outside the said bolt's thread area. If the routing valve 9 is to be removed after the ball-cocks 33, 35, 37, 39 and 41 have been closed, the screw 69 is unscrewed from the thread 67, whilst the locking screw 71 prevents the built-up screw 63 from turning with it. The intermediate plate 11 thus remains securely screwed to the connection plate 1. The mounting space 61 must be sufficiently large to allow space not only the screw-head 65 but also a wrench which can be placed thereon. The mounting space 61 must therefore lie sufficiently far above the region of the actuation drill-holes 49, 51 or 53. Thus, if necessary, the intermediate plate 11 has to be slightly thicker than is required by the ball-cocks alone. The diameter of the drill-hole forming the mounting space 61 can be kept smaller by means

of a special design of the built-up screw 63, namely with a special head which apart from the internal thread 67 also provides possibilities for engaging special wrenches, for example a hexagonal recess disposed below the internal thread 67, for a hollow wrench (as shown in dashed outline in Figure 5) or pinning holes in the upper surface of the head 65.

In the case of the construction according to Figures 6 to 8 an ordinary recessed-head screw 73 serves to fix the intermediate plate 11 to the connection plate 1. With this construction the fixing holes 25 are again divided into the lower drill-hole 59, through which passes the screw shaft of the screw 73, and the mounting space 61 in the form of the upper drill-hole. The fixing hole 25 crosses the actuation drill-hole 49 incorporating the torsion bar 43 at right angles at a moderate distance.

A channel 75 in the form of a circular cylindrical drill-hole runs into the mounting space 61, according to Figure 6 from the lateral surface of the block 11 as shown in Figure 7. Into this channel is inserted, in a specified angular position and in such a way that it can be taken out, a bolt or cylinder 77 having a radial thread drill-hole 79 with a thread which corresponds to the screw with which the routing valve 9 is to be mounted. When the cylinder 77 has been put in, an adjustment pin 81 is inserted into a drill-hole located half in the cylinder and half in the material of the intermediate plate 11, which causes the thread drill-hole 79 to be aligned with the lower drill-hole 59. Distortion is no longer possible while the routing valve 9 is being put on. The insertion depth on the cylinder 77 can be fixed, for example, by the rear limit of the channel 75. Other types of construction, for instance a parallelepipedal structural component with the thread drill-hole 69, are also possible, but less preferable for reasons of cost, especially with regard to construction of the channel 75. A tightening pin serves as the adjustment pin 81.

For fixing according to Figures 6 to 8, the screw 73 is first of all inserted, with a view to screwing the intermediate plate 11 to the connection plate 1, into each of the four fixing holes 25 through the corresponding mounting spaces 61 and tightened with the aid of a hollow wrench. The cylinders 77 are then inserted into their channels 75 and wedged with the adjustment pins 81. The routing valve 9 can then be put on and fixed with screws which resemble the screws 73 in the thread and are screwed in the thread drill-holes 79 of the cylinders 77. The tightening of these screws secures the cylinders 77 non-positively in the intermediate plate 11 so that any slight displacement which might otherwise have been possible in the axial direction of the channels 75 is no longer possible. In so far as the different channels 75 have a differing axial direction, i.e. end at lateral surfaces facing in different directions, positive securing is also possible.

For later removal of the routing valve the latter's screws can simply be screwed out of the thread drill holes 79. If the intermediate plate 11 is also to be dismounted, the cylinders 77 are taken out of the intermediate plate 11, whereupon the screws 73 can be freely unscrewed and removed through the mounting space 61.

Since the standardized measurements are strictly adhered to, the intermediate plates are also suitable for re-equipping existing plants.

Claims

1. An intermediate plate for a hydraulic linkage system for insertion between a linkage connection plate and a connection or control block branching off from the latter, with connection drill-holes whose hole patterns resemble those of the connection plate or of the connection or control block and between which run channels which at least partially envelop stop-cock devices for hydraulic switch functions, and having fixing holes, for fixing the intermediate plate between the connection plate and the connection or control block, which are formed for separate screwing of the intermediate plate on the one hand to the connection plate and on the other hand to the connection or control block.

2. An intermediate plate according to claim 1, wherein one or several actuation drill-holes run to the stop-cocks from one or both of the end faces of the intermediate plate.

3. An intermediate plate according to claim 1 or claim 2, wherein, at the location of the fixing holes of the connection plate and of the connection or control block, there is, in the intermediate plate, on the one hand a fixing hole for a screw to be screwed in the connection plate and on the other hand a mounting space for insertion of a thread for a screw holding the connection or control block.

4. An intermediate plate according to claim 3, including screws for screwing the intermediate plate to the connection plate each such screw being built-up screw which has a drill-hole with an internal thread in the screw-thread coaxially with its bolt, and that a drill-hole receiving the screw-head runs into the intermediate plate from the connecting surface of the connection or control block to form the mounting space.

5. An intermediate plate according to claim 4, wherein the built-up screw is arranged to be locked in a desired position.

6. An intermediate plate according to claim 2 and in combination with claim 4 or claim 5, wherein the fixing hole adjoining the drill-hole receiving the screw-head for passage of the shaft of the built-up screw to the connection plate seen from the connecting surface of this connecting plate, runs past the nearest actuation drill-hole, intersecting at right angles, and that the enlarged mounting space receiving the screw-head only lies behind it.

7. An intermediate plate according to claim 3, wherein a drill-hole for receiving the screw-head of the screw to be screwed in the connection

plate runs from the connecting surface of the connection or control block into the intermediate plate provides the mounting space and a channel running from one of the side faces of the intermediate plate opens into this drill-hole and into this channel is inserted a retractable bolt having a transverse drill-hole with a thread which is aligned with the fixing holes.

8. An intermediate plate according to claim 7, wherein the channel and the bolt, each of circular cross-section, are secured against torsion relative to each other with an adjustment pin.

9. An intermediate plate according to claim 7 or claim 8,wherein the bolt can be completely removed from the intermediate plate.

10. An intermediate plate according to any one of claims 7 to 9, including screws to be screwed in the connection plate each in the form of a recessed-head screw.

11. An intermediate plate according to any one of claims 1 to 10 incorporating hole patterns according to DIN 24340.

12. An intermediate plate according to claim 1 and substantially as herein described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1979. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.